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Investigation of Geographic Dependence of Inverse Barometer and EM Bias Effects in TOPEX Altimetry

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ABSTRACT

Electromagnetic bias (EMB) and the inverted barometer effect (IB) remain troubling effects in using altimeter data for oceanography. It has been found that applying the IB is essential to getting physically meaningful EMB representations. It is physically reasonable that the two are highly correlated as low pressure is generally associated with high winds and high waves. Here we explicitly investigate EMB, IB, and the relationship between wind speed (or σ_0) and significant wave height (SWH) as functions of latitude. We also characterize the EMB separately as a function of wind driven waves and swell. This experimental correlation should lead to a better physical understanding of EMB and of wave generation. The relationship of EMB to wind driven waves and swell can be used to reduce the apparent geographic variation of EMB.

The investigation is carried out in two steps. First, for latitude bands we determined the joint distribution of σ_0 or wind speed, SWH, and IB. These three dimensional distributions were projected into each for the principal planes to determine correlations that could be exploited in recovering the EMB from data differences. A well-defined relationship between σ_0 and SWH was found. It was used as the basis for some of the fits for EMB. The relationships between IB and SWH and σ_0 were less well defined, but generally, SWH and IB are more correlated with wind speed at higher latitudes.

Second, we used repeat track differences from adjacent cycles of TOPEX data to determine the dependence of EMB on wind speed and SWH as a function of latitude. It is also possible to simultaneously solve for EMB and IB from the data. EMB is a larger percentage of SWH of higher latitudes. We then attempted to remove the apparent latitude dependence by using the largely latitude independent relationship between σ_0 and SWH. The results of these investigations will be reported. Discussion of the relationship between small scale surface roughness as given by σ_0 and the larger scale SWH will be given.